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ABSTRACT

The "Perceptual Preferences" section of the Learning Styles Questionnaire (Dunn and Dunn, 1975) was administered to 170 ninth grade students with self-reported measures of self-esteem, general affect, and achievement (i.e., grade-point average). Data were analyzed to determine if modality preferences are a significant component of student learning styles, whether or not male and female students differ with respect to learning style preferences, and whether or not learning style preferences are related to self-concept and general affect. Ten learning style preferences identified were: (1) reading; (2) manipulative activity; (3) teacher explanation; (4) auditory stimulation; (5) visual demonstration; (6) visual stimulation (electronic); (7) visual stimulation (still pictures); (8) games; (9) social interaction; and (10) personal experience. The conclusion was reached that modality preferences in adolescent learners are complex and interwoven with other preference aspects. Males differed from females in showing a greater preference for manipulative learning activities and a lesser preference for teacher explanation and direction and for learning by reading. Correlations of learning style preferences with self-esteem and general affect were not significant for the sample as a whole. Teachers should use caution in using modality preferences of students as a basis for planning instruction or selecting curricular experiences. (Author/JD)

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PERCEPTUAL PREFERENCES AS AN ASPECT OF ADOLESCENT LEARNING STYLES

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PERCEPTUAL PREFERENCES AS AN ASPECT OF

ADOLESCENT LEARNING STYLES

The search for individual differences which correlate with and predict school achievement has long been a theoretical and practical concern in education. Bloom (1976) cites more than 200 examples of studies of cognitive and affective predictors of achievement in his attempt to determine the relative contribution of these factors to achievement variation. In his analysis of existing research evidence, Bloom identifies prior achievement, as well as general and specific aptitudes as cognitive predictors. School and subject-matter attitudes and academic-self-concept are identified as relevant affect categories.

While Bloom has organized this evidence to show its relation to and support for the mastery-learning theory, the specific cognitive and affective variables studied in the research have generally not proved to be of great usefulness in practical educational settings. As Hunt (1981) points out, psychological descriptions of individual differences (both cognitive and affective) have often seemed to use "static terms" which offer little or no insight into how a teacher may work with the student. An alternative that is more favorably received by teachers is to describe student differences in terms of "accessibility characteristics", qualities which are directly translatable into teacher action. This is the basic source of appeal in the use of the concept of student learning styles to describe individual differences:

> Knowing about learning-style differences also suggests to the practitioner the most appropriate instructional approach." (Hunt, 1981, p. 647)

Textbooks in educational psychology usually identify a relatively brief history for the concept learning-styles. Strom and Bernard (1982, 181-205), for example, refer to articles by Riesmann (1966) and Nations (1967) as orgins of the term, if not the concept. Of these, Nations appear to have offered the more explicit

conceptualization by describing a learner style as an integration of three components: a sensory orientation (essentially a modality preference), a responsive mode (preferences for group or individual work, for active participation or keen observation, individual autonomy or teacher, director, etc), and a thinking pattern (preferences for inductive, intuitive approaches or deductive, linear thinking). Even a cursory examination of the literature on learner styles, however, suggests that its conceptual origins are at least as old as the work of Witkin (1950) on "psychological differentiation" and what has come to be referred to as "cognitive style". Witkin's distinction between "field-independent" or analytic perceivers and "field-dependent" or context-sensitive perceivers is, at the very least, an aspect of what Nations calls thinking pattern.

Regardless of its origins, the concept of learner styles has been the focus of recent attempts to identify "accessible" characteristics of adult learners (Kolb, 1976), secondary school students (Gregorc and Ward, 1977), and elementary and middle school pupils (Dunn and Dunn, 1975). Of these, the approach of Dunn and Dunn is easily the most comprehensive. Eighteen factors grouped into four categories of stimulation are hypothesized to determine learner style. How a person learns depends on his or her reaction to aspects of immediate environment (sound, light, temperature, and casual or formal design), emotional make-up (level of achievement motivation, persistence, willingness to assume responsibility, ability to work independently), sociological reaction to people (preferences for size and type of group interaction), and physical being (perceptual modality preferences, level of need for intake, time-of-day preferences, and need for mobility and activity). A self-report instrument consisting of approximately 180 true/false questions has been designed to provide a basis for information about a learner style which can be translated into immediate teacher action. For example, teachers who discover (as most will) that some of their students prefer a casual environment, one less structured than a formal classroom, are encouraged to create a more differentiated

workspace with one section or area that is more like a living room or den than a classroom.

The approach taken by Dunn and Dunn has been criticized as conceptualizing learner styles as a given to which the instructional process must be adapted. An alternative is to view learner styles as malleable qualities which are themselves appropriate targets of change in an educational context (Davidman, 1981). Further Davidman questioned the usefulness of self-report items in general and specifically identified possible sources of ambiguity in selected items of the Learning Styles Questionnaire (LSQ).

Dunn and Dunn describe a procedure for scoring the Perceptual Preferences section of the LSQ which identifies four separate scores, one for each modality (1957, p. 106). In a study reported later, however, they describe a factor analysis of the LSQ for 1000 subjects in grades 1-12. In this analysis, a separate factor could not be identified for tactile and kinesthetic modalities (Price, Dunn and Dunn, 1977). In addition, they report several trends with respect to perceptual preferences over grade levels and several differences between male and female students. Preferences of male and female students for a tactile/kinesthetic modality decrease from grade 1 to grade 2. Preferences for auditory modality increased over grades 1 to 12, but only for female students. Significant differences between males and females are reported with males prefering tactile/kinesthetic modality (in grades 5 and 6) and visual modality (in grades 6 and 11). Females showed a preference for the auditory modality (grades 6, 10, and 12).

Problem Statement

In the light of the questions raised as well as findings reviewed, the current study examined whether or not ninth grade students exhibit modality preferences of the type impled by Dunn et. al. The following questions were used to direct the

analysis of a data set previously collected as a part of an evaluation study of a career education project:

1. Do students responses to self-report items eliciting modality preferences describe the four factor structure implied by the LSQ: Auditory, Visual, Tactile, and Kinesthetic?

2. How are sex and achievement differences related to the learning style factors reflected in self-report questions of modality preference?

3. Are learning style or modality preference factors correlated with measures of affect?

Method

Context and Sample

One hundred and seventy, ninth grade students of a rural Michigan high school participated in the original study which was designed to assess the effectiveness of instructional materials which had been selected to facilitate growth of self-awareness, self-esteem, and the ability to live and work with others. The materials were used and testing was done as a part of the students' regular English classes. Not all students were present for all testing. For the analyses presented in this report the effective sample size ranges from n=136 to n=157.

Instruments

Assessments were conducted with two self-report instruments (pre and post-test), each of which included several scales:

How I Learn Best. This is a 31 item inventory of modality preferences based on the "Perceptual Preference" section of the Learning Style Questionnaire of Dunn and Dunn (1975). Originally designed as true-false questions, in the current study

LSQ Items were converted to a 4-point Lakert scale. Specific statements were grouped under three introductory phrases: (a) "If I have to learn something new, I like to learn it by . . .", (b) "The things I remember best are the things. . .", (c) "In my spare time I really like to . . .". The various alternatives for completing these sentences allow students, in theory, to express auditory, visual, tactile or kinesthetic modality preferences. For example, responses to "In my spare time I really like to . . ." included:

visual preference--"read books, magazines, or newspapers"
auditory preference--"listen to records"
tactile preference--"draw pictures"
kinesthetic preference--"play sports and games"

What Would You Do? This 20 item scale is published by the Instructional Objectives Exchange (Los Angeles, California) as an inferential, self-report measure of self-esteem. It consists of a series of fictitious situations, each followed by four actions or interpretations. The respondent is asked to choose which of the four is most like what he or she would think or do. Two of the four choices reflect the behavior or thoughts of one who possesses a positive self-concept, while the others reflect a negative self-concept. According to the publisher the situations posed in the instrument were drawn from the research literature on self-concept (Coopersmith, 1967 and Wylie, 1961). The situations include those that involve: a) the need to accommodate to the wishes of others, b) expectations of acceptance by others, c) the courage to express one's opinions, d) a willingness to participate in activities, and e) expectations of success. The higher score on the inventory the more positive the self-concept of the respondent.

Choose A Job. This is a 40 item scale published by the Instructional Objectives Exchange as an inferential, self-report measure of self-esteem. It consists of items which the respondent is asked to consider as a list of want-ads for jobs such as those found in the classified section of newspapers. The respondent is asked to read all of the items and select the 10 jobs he or she would most like

to have as an adult. The items include jobs rated in three levels of social esteem: high (doctor in a small town hospital); middle (computer programmer); low (unskilled laborer). Points are assigned for each of the students choices depending on which esteem level the job is associated with.. The instrument is based on the assumption that students with positive self-concepts will aspire to positions which reflect the following qualities: high salary, advanced educational requirements, high level of creativity and problem-solving, the need to be assertive, the tendency to take risks and be venturesome. High scores on this scale reflect the more frequent choice of high esteem jobs which involve these characteristics.

Moods and Feelings. This 21 item checklist is a modification of the A-scale of the "Multiple Affect Adjective Checklist" (Zuckerman and Lubin, 1965). It consists of adjectives, some referencing positive moods and feelings (calm, cheerful, happy, loving) and some referencing negative emotional states (tense, agitated, worrying). Students were instructed to check those adjectives which described how they "generally" feel. Responses were scored for the number of positive items checked and the number of negative items omitted. Higher scores reflect more positive affect states and feelings absent of anxiety, worry or fear.

Grade Point Average. Students were asked to report their grades for all classes for the most recent reporting period and a grade point average was calculated (A=4, B=3, C=2, etc.).

Procedure

Two of the scales described above (What Would You Do? and Choose A Job) were included on the pre and post-test surveys to determine if any change occured during the program being evaluated. For the purpose of this study, the scores for the two time periods were averaged to provide a single score. The other scales were included in the post-test survey only.

Data Analysis

The 31 items of the How I Learn Best instrument were subjected to a factor

analysis using a principle factor solution and a VARIMAX rotation of factors. The learning style factors identified were labelled and used as dependent variables in a series of two factor analyses of variance with grade point average (five levels) and sex as independent variables. Correlations of learning style factors with affect measures were calculated. All computations were carried out on a CDC Cyber 172 Computer using the appropriate SPSS statistical routines (Nie, Hull, Jenkins, Steinbrenner, and Bent, 1975).

Results

These data were analyzed to provide answers to three major questions regarding the learning styles of adolescent students: a) Are modality preferences a factor in student learning styles? b) Do male and female students and students at different levels of achievement express differing learning style preferences? c) How do learning style characteristics relate to student self-concept and general affect?

Modality Preferences in Adolescent Learning Styles

According to the format suggested by Dunn and Dunn (1975) four factors should be revealed by a factor analysis of the 31 items of the How I Learn Best inventory, each factor reflecting one of four modality preferences: auditory, visual, tactile or kinesthetic. The factor analysis of the responses of 157 students resulted in ten interpretable factors. Table 1 presents the items, factor loadings, and percent of common variance associated with each of these factors. In addition, a tentative interpretation of each factor is provided.

The ten aspects of learning styles identified in the factor analysis are related to perceptual preferences. Reading, Visual Demonstration, Visual Stimulation, Electronic Visual Stimulation, and Personal Experience have a visual quality to them. Teacher Explanation, Auditory Stimulation, and Social Interaction emphasize

an auditory preference. Manipulative Activity and Games reflect a combination of tactile and kinesthetic preferences.

Insert Table 1

In addition the data of the current study suggest that different modality preferences are not equally important as qualities of individual differences among students. The percent of variance accounted for by the five factors which are substantially visual is 47.3 percent; for the three factors which are auditory, 27.2 percent, for the two tactile/kinesthetic factors, 21.4 percent. One aspect of a visual preference, the Reading factor, by itself accounts for almost as much of the variance as the summed auditory and tactile/kinesthetic factors.

As an aspect of the learning style of adolescents, modality preference is a complex phenomenon and not adequately or accurately expressed in terms of four equally important categories. Ten factors were necessary to account for the variation in the 31 item inventory used in the study.

Learning Style Characteristics and Achievement

Using the ten factors previously identified as qualities or aspects of student learning styles, it was possible to determine which of these characteristics differed systematically with different levels of achievement and with sex difference using a two-factor analysis of variance. Table 2 presents a summary of these results. As shown in Table 2, two of the learning style factors, Reading and Visual Demonstration,

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Insert Table 2
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are significantly related to grade point average. For four of the characteristics there are significant differences between male and female students: Reading, Manipulative Activity, Teacher Explanation, and Auditory Stimulation (Electronic).

Finally a significant interaction between grade point average and sex is identified for two factors: Teacher Explanation and Visual Demonstration. Each of these findings is briefly explained as follows:

1. Preference for Reading was linearly related to GPA with the students at the highest level of achievement expressing the highest preferences.

2. Preference for Visual Demonstration was not linearly related to GPA (An F test of deviation from linearity was significant at the $p < .05$ level). Of five GPA groups, the lowest and the highest showed the greater preference, while the moderately low and moderately high GPA groups expressed lower preferences.

3. Sex differences in preferences were defined as follows: Males showed greater preference than females for Manipulative Activity and less preference for Teacher Explanation, Auditory Stimulation (Electronic), and Reading.

4. Althought the pattern of interactions between GPA and sex were complex, and different for the two factors, Teacher Explanation and Visual Demonstration, there is one common element. The greatest discrepancies between subgroups of male and female students occurred for high achieving students with females expressing a greater preference than males. The reverse was true in one or more lower achieving subgroups.

In summary, both factors shown to be significantly related to achievement (as represented by grade-point-average) were aspects of a visual modality preference. Significant interactions were noted for factors representing each modality: visual, auditory, and the combination tactile/kinesthetic.

Learning Style Correlation with Affective Measures

Table 3 shows the product moment correlations between learning style factors and three measure of affect: Correlations are presented for the total sample and for male and female student subsamples. For the total sample, one of the 30 correlation coefficients was statistically significant at the .05 level of probable error in rejecting a null hypothesis. This result was a small, positive correlation ($r=.17$) between preference for games and the measure of mood in general. Since

one statistically significant result out of 30 tests at a .05 level is consistent with random sampling and chance factors this result was not considered to be a sufficient weight to reject the general null hypothesis that learning style preferences and measures of self-esteem and mood are uncorrelated.

Insert Table 3

When the sex of the student as moderating variable was taken into account, however, a pattern of statistically significant results for two learning style preferences, Auditory Stimulation and Visual Demonstration, with measures of self-esteem and mood was revealed. Among the 12 correlations between these two learning style preferences and three affect measures for males and females considered as separate samples, 5 were significant. For female students preference for auditory stimulation was negatively correlated both measures of self-esteem ($r = -.36$ and $r = -.23$). For male students preference for Visual Demonstration was negatively correlated with both measures of self-esteem ($r = 0.24$ and $r = -.29$). In addition, for males, preference for Auditory Stimulation was negatively correlated with mood ($r = -.23$).

Discussion and Conclusions

The work of Dunn and Dunn (1975) suggests that one aspect of learning style is perceptual modality preference and their Learning Style Questionnaire describes a procedure for assessing these preferences as if they were single, equally important factors and independent of other aspects of learning style. In the current study, ten separate factors were found necessary to account for the variance in the self-descriptions of learner preference using 31 items based on the perceptual modalities categories of the Learning Style Questionnaire.

It seems reasonable to conclude that modality preferences in adolescent learners are more complex than the simple four factor schema suggested by the LSQ scoring procedure. Visual preference, for example, seems not to be single construct, but rather several relatively independent qualities of learner preference each of which involves the visual modality: Learning by reading, learning by visual demonstration, learning by pictorial visual stimulation, learning by electronic visual media, and learning by personal experience. In the factor analysis reported by Price, Dunn and Dunn (1977), three modality preference factors were identified for a sample which included subjects selected from all grade levels. The current results fail to confirm that result. Until additional research has been conducted, teachers of adolescents would be well advised to avoid attempting to draw definitive conclusions about learner modality preferences as a starting point for the development of teaching strategies or materials.

Another reason for caution in using scores which purport to identify modality preferences was found in the data of the current study which showed various preferences to be of different levels of usefulness in describing learner variability. Visually related factors account for more variability than either auditory or tactile/kinesthetic. A teacher might find a strategy of looking for specific learner differences among the various aspects of a visual preference as useful as looking for gross differences in modality preference.

The data of the current study show that two aspects of learning style are significantly related to school achievement. High achieving students have greater preferences for learning by reading than moderate and low achieving students. A greater preference for visual demonstration is indicated for both high and low achieving students than for moderate achievers. These results underscore the importance of distinguishing among the several aspects of a visual preference.

With respect to sex differences, the results of the current study are both consistent and inconsistent with the earlier findings of Price, Dunn and Dunn (1977).

In the current study males showed preference for manipulative activity. This is consistent with an aspect of the earlier research which showed that males preferred tactile/kinesthetic experiences to a greater extent than females. Females showed a greater preference for Teacher Explanation and Electronic Auditory Stimulation in the current study. These are both aspects of an auditory modality preference for which females showed a greater preference in the earlier study. One inconsistency appeared in that females showed greater preference than males for Reading in the current findings while the early data show males with a greater preference for a visual modality of which Reading would be an aspect.

For two other aspects of learner style, sex by achievement level interactions were noted. These interactions are largely due to the relatively greater preferences of high achieving females for Teacher Explanation and Visual Demonstration. The meaning of these sex differences is unclear, but there is no reason to suspect that these differences are due to factors other than the differential socialization practices which exist in the home and the school for boys and girls.

In general, correlations of learning style preferences with two measures of self-esteem and a measure of general affect were not significant. For samples of males and females, however, significant negative correlations were noted. For females both measures of self-esteem were negatively correlated with preferences for Auditory Stimulation. For males preference for visual demonstration was negatively correlated with both self-esteem measures. These result seem to suggest that male and female low self-esteem students have slightly different learning styles than their same sex peers. Low self-esteem females, as compared to their high self-esteem students of the same sex, tend to have greater preferences for Electronic Auditory Stimulation. This seems to be more of a preference for diversion, distraction, or entertainment than for a type of learning activities. The items of the Electronic Auditory Stimulation involve preference for listening to records and radio in one's spare time.

Low self-esteem males have greater preferences than other males for an aspect of modality preference that may be more clearly related to a learning style and more adaptive in a school context, i.e., a preference for being shown how to do something through visual demonstration. The current study was not conducted in a way that permitted conclusions about whether any of these variables, sex role socialization, self-esteem, or learning style preference, is causally related to the others.

In summary, perceptual modality preferences are not separate, unitary aspects of learning style unrelated to factors such as the content of the preference. Gross modality preferences are each multidimensional. Instruments and assessment approaches that lead teachers and researchers to consider modality preference in general terms may do more to contribute to the misunderstandings of individual learner differences than to further a commitment to developing and using information on individual differences in teaching.

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Table 1

Factor Structure of the LSQ Perceptual Preferences Section

Factor		Items	Loadings	% of Variance
Reading	(1)	If I have to learn something new, I like to learn it by reading.	.84	22.9
	(12)	The things I remember best are things I read in books or magazines.	.59	
	(17)	In my spare time I really like to read books, magazines, or newspapers.	.69	
	(31)	In my spare time I really like to go to the library.	.55	
Manipulative Activity	(28)	In my spare time I really like to build things.	.72	15.8
	(29)	In my spare time I really like to do experiments.	.64	
	(30)	In my spare time I really like to work with machines and equipment.	.71	
Teacher Explanation	(5)	If I have to learn something new, I like to learn it by hearing my teacher tell me.	.86	12.4
	(9)	The things I remember best are the things my teacners explain to me.	.59	
Electronic Auditory Simulation	(18)	In my spare time I really like to listen to records.	.76	10.2
	(25)	In my spare time I really like to listen to the radio.	.72	

Table 1 (Continued)

Visual Demonstration	(4)	If I have to learn something new, I like to learn it by looking at pictures and having someone explain them.	.62	8.1
	(8)	If I have to learn something new, I like to learn it by having someone show me.	.78	
Visual Stimulation	(20)	In my spare time, I really like to draw.	.51	7.0
	(21)	In my spare time, I really like to look at pictures.	.66	
Electronic Visual Stimulation	(13)	The things I remember best are the things I saw on television.	.71	5.7
	(15)	The things I remember best are the things I saw in a movie.	.43	
Games	(6)	If I have to learn something new, I like to learn by playing games.	.66	5.6
Social Interaction	(23)	In my spare time, I really like to talk to interesting people.	.68	4.6
	(24)	In my spare time, I really like to listen to people talk about things they've done.	.55	
Personal Experience	(7)	If I have to learn something new, I like to learn it by going someplace and seeing for myself.	.69	3.6

Table 2: ANOVA for Learning Style Factors by GPA and Sex

Learning Style Factor	Source	df	Mean Square	F	P<
Reading	GPA	4	671.481	3.29*	.013
	Sex	1	369.908	17.18*	.001
	Interaction	4	191.719	1.71	.152
	Residual	126	112.284		
Manipulative Activity	GPA	4	119.649	.839	.503
	Sex	1	2613.335	18.319*	.001
	Interaction	4	37.053	.260	.903
	Residual	126	142.659		
Teacher Explanation	GPA	4	292.096	1.99	.100
	Sex	1	638.441	4.35*	.03
	Interaction	4	460.379	3.14*	.017
	Residual	126	146.870		
Auditory Stimulation (Electronic)	GPA	4	25.818	.30	.879
	Sex	1	824.055	9.49*	.003
	Interaction	4	73.116	.84	.501
	Residual	126	86.863		
Visual Demonstration	GPA	4	318.676	2.39*	.054
	Sex	1	36.545	.27	.601
	Interaction	4	427.466	3.21*	.015
	Residual	126	133.253		
Visual Stimulation (Electronic)	GPA	4	21.927	.20	.936
	Sex	1	87.227	.81	.371
	Interaction	4	5.423	.05	.995
	Residual	126	108.087		
Visual Stimulation (Still Pictures)	GPA	4	88.782	.55	.699
	Sex	1	315.581	1.95	.165
	Interaction	4	284.195	1.76	.141
	Residual	126	205.946		
Games	GPA	4	29.875	.27	.927
	Sex	1	24.888	.23	.634
	Interaction	4	30.467	.28	.891
	Residual	126	109.315		
Social Interaction	GPA	4	21.893	.14	.969
	Sex	1	188.879	1.16	.283
	Interaction	4	161.856	1.00	.412
	Residual	126	162.418		

Table 2 (Continued)

Learning Style Factor	Source	df	Mean Square	F	P<
Personal Experience	GPA	4	77.858	.76	.551
	Sex	1	294.856	2.89	.091
	Interaction	4	112.734	1.11	.356
	Residual	126			

*P< .05 is usually considered statistically significant.

Table 3

CORRELATION OF LEARNING STYLE PREFERENCES

&

MEASURES OF AFFECT

Learning Style Factor	Affective Variables								
	What Would You Do?			Choose A Job			Mood		
	Males	Females	TOTAL	Males	Females	TOTAL	Males	Females	TOTAL
Reading	.11	-.12	.07	.17	-.16	.07	-.12	.04	-.04
Manipulative Activity	-.20	.21	.07	-.16	.20	.07	.04	-.07	-.03
Teacher Explanation	.09	.01	.01	.17	.05	.06	-.11	-.05	-.08
Auditory Stimulation	.10	-.36*	-.11	.07	-.34*	-.13	-.23*	.00	-.11
Visual Demonstration	-.24*	-.03	-.09	-.29 *	.00	-.08	.12	.16	.14
Visual Stimulation (Electronic)	.03	-.01	.01	.11	-.04	.01	.21	-.18	-.02
Visual Stimulation (Still Pictures)	.03	.11	.13	.08	.10	.14	.14	-.18	-.03
Games	.11	-.19	-.00	.14	-.11	.04	.20	.14	.17*
Social Interaction	-.06	-.07	-.04	-.02	-.05	-.02	-.03	.15	.06
Personal Experience	-.15	-.16	-.10	-.14	-.12	-.08	.16	-.17	-.01

*P < .05